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Emotion Experience to Expression: Influence of Psychopathy, Expression Suppression, and Working Memory

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EMOTION EXPERIENCE TO EXPRESSION: INFLUENCE OF PSYCHOPATHY, EXPRESSION SUPPRESSION, AND WORKING MEMORY

by

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ABSTRACT

The intent of this thesis is to explore the perceived discrepancies between individual scores of psychopathy, particularly the division of primary and secondary psychopathy, and how such scores may moderate the relationship of one's emotional experiences with the corresponding emotional expression. There is evidence to consider that a person's working memory ability and/or volitional suppression of expression may also moderate this relationship and result in constricted emotional expression, a trait often found in primary psychopathy. Undergraduate participants completed the study online, and after exclusions, a final sample size of 126 participants (62.7% women) was used in analyses. An initial linear regression found that primary psychopathy severity showed a negative relationship with performance on a visuo-spatial n-back test of working memory. While age did not relate to expression, women reported a greater strength of expression for both negative and positive emotions than men. Using hierarchical linear regressions, a significant four-way interaction was found between primary psychopathy severity, working memory performance, degree of volitional expression suppression, and internal emotional experience, in predicting the strength of expressing negative emotions. Analysis of simple effects revealed that, for participants scoring higher in primary psychopathy (n = 63), there was a significant three-way interaction for experience of negative emotions, the use of emotional suppression, and working memory performance in predicting the strength of expressing negative emotions. Simple effects of this interaction showed that for a subgroup who were higher in primary psychopathy and volitional suppression of emotional expression (n = 25), there was significant negative relationship between the frequency of experiencing negative emotions and the strength of expressing those emotions. There were no significant interactions involving secondary

psychopathy severity or variables relating to positive emotions in any regression. The findings of this study could be useful for future research on psychopathy as it relates to understanding the characteristics and functioning of individuals with psychopathy.

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INTRODUCTION

A line of existing research has examined mediators of the connection between innate emotional experience and outward signs of emotional expressivity. However, there does not appear to be published research on this topic in individuals with either categorical or dimensional psychopathy. In research on other psychopathologies, researchers have found various ways to explain a disconnect between internal emotional reactivity and a blunted external emotional response. For example, limits to executive functioning capabilities (e.g., working memory) and one's cognitive workload has been found to impede the ability for inward emotion to be externally expressed (reviewed below). Other researchers examine the extent to which individuals utilize emotional suppression that, as discussed below, allows one to intentionally suppress the expression of emotion (e.g., facial expression, vocal acoustic), even though one may internally experience the emotion. The purpose of the current study is to examine the connection between emotional experience and subsequent emotional expression in relation to dimensional psychopathy factors along with other potential mediators, including level of emotional suppression and working memory functioning.

Psychopathy or psychopathic personality is a construct that subsumes a myriad of features, to include: superficial and insincere interpersonal relations, lack of empathy and remorse, pervasive antisocial behavior, and impulsivity that often leads to delinquent behaviors (Hare, 2003). In its extreme form, psychopathy is believed to affect approximately one- to two percent of the general population; however, this accumulates to an estimate of fifty-percent of violent offenders (Rutter, 2012; Lösel, 2001; Dolan & Doyle, 2000). Consistent with such

findings, individuals with higher levels of psychopathic traits are associated with an above-average number of recorded criminal offenses and such a diagnosis is a principal factor in predicting future violence, serious transgressions, and recidivism (Künecke, Mokros, Olderbak, & Wilhelm, 2018; Dhingra & Boduszek, 2013). Studying the etiological basis and subsequent ramifications of antisocial behavior have led researchers to focus primarily on antisocial personality disorder (APD) and psychopathy (Vaidyanathan et al., 2011). APD is a personality disorder found within the Diagnostic and Statistical Manual of Mental Disorders (DSM; American Psychiatric Association [APA], 2013), whereas psychopathy is a personality construct created by Cleckley (1941). Although both share several standard features, APD and psychopathy are distinct in many ways.

Whereas both constructs include a persistent antisocial deviancy originating in childhood and pervading into adulthood, psychopathy is distinct insofar that it features a deficit in emotional attributes and characteristics. Coid and Ullrich (2010) pertinently wrote that psychopathy might be the extreme form of APD in which it has distinguishing features (e.g., affective interpersonal traits). Contemporary conceptualizations of psychopathy originated with Cleckley's (1941) "The Mask of Sanity," which delineated sixteen specific criteria for the psychopathic disorder that incorporated interpersonal and affective characteristics. The encompassment of such features includes information that has been absent in diagnostic criteria APD; thus, raising criticism for its functionality and generalizability. Though psychopathy has conventionally been defined as a unitary taxon, recent research posits that its recognizable features allow it to be defined using two underlying factors (Edens, Marcus, Lilienfeld, & Pythress, 2006; Murrie et al., 2007; Walters, Duncan, & Mitchell-Perez, 2007; Coid & Yang,

2008). The first factor (factor one) encompasses issues that reflect the core of interpersonal and affective features emphasized by Cleckley and the second factor being used to describe behaviors reflecting a deviant and impulsive lifestyle (Hare et al., 1991). Factor one and factor two are frequently referred to as primary and secondary psychopathy, respectively. The division of Cleckley's original sixteen criteria constructs into two factors allows research to examine psychopathy in a community sample as opposed to limiting research to psychopathy within violent offenders and prison inmates (Sellbom & Verona, 2007). This particular method of studying psychopathy reverses the traditional way in which it was defined categorically and allows for dimensional usage; thus, permitting researchers to study beyond psychopathy as a dichotomy and enable individuals to be placed and examined on a spectrum.

To evaluate psychopathy, a multitude of empirical articles have used and, in turn, established the psychometric validity and reliability of the Psychopathy Checklist-Revised (PCL-R; Olver & Wong, 2015; McCuish et al., 2015; Forth & Mailloux, 2000; Salekin et al., 1997). The PCL-R measurement of psychopathy is, by many researchers, considered the gold-standard for measuring the trait whereby short-versions and related tests often establish associations to the original source. However, there have been ongoing debates on which traits are crucial and indispensable to the construct. For some, the two factor model from the PCL-R is pertinent to the success of studying the trait (Harpur & Hare, 1989; Boduszek & Debowska, 2016; Rice & Harris, 1995; Khiroya et al., 2009), whereas, for other researchers, a competing three-factor model is preferred (Patrick, 2010). For this, researchers developed a triarchic model (Cooke & Michie, 2001) and a subsequent self-report scale, the Triarchic Psychopathy Measure (TriPM; Patrick 2010; Patrick et al., 2009; Patrick & Drislane, 2015; Roy et al., 2020) which produces

factor scores for Boldness, Meanness, and Disinhibition. A smaller group of researchers prefer a four-factor model (e.g., interpersonal, affective, lifestyle, and antisocial; Vitacco et al., 2008; Hare & Neumann, 2006).

The absence of a conceptual and inherent consensus concerning which approach is most effective has led to research that examines the advantages and effectiveness of assessing psychopathy with models and related scales ranging from two to four factors (Tsang et al., 2018). In one study, Cooke and Sellbom (2019) discovered that four-factor models had less consistent support as opposed to a three-factor model. Such findings are further corroborated by other studies finding inconsistencies in the four-factor model of psychopathy (Boduszek & Debowska, 2016; Cooke et al. 2007). Concerning the use of a two-factor or three-factor model, researchers have been unable to reach a consensus as to which model is more valid for studying psychopathy (Tsang et al., 2018). However, some researchers frequently describe the three-factor model as overlooking and, thus, excluding a factor score specific to antisocial and criminal behavior (Boduszek & Debowska, 2016). A number of psychopathy researchers have argued that inclusion of a specific antisocial facet score (i.e., secondary psychopathy) is an integral and fundamental part in the measurement of psychopathy (Boduszek & Debowska, 2016; Skeem & Cooke, 2010). While a two-factor model is also not without limitations (e.g., Kosson et al., 1990; Salekin et al., 1997), instruments assessing psychopathy with a two-factor model have been substantiated and recommended in studying primary and secondary psychopathy, respectively (Tsang et al., 2018).

It is proposed that the PCL model constitutes one latent entity that is subsequently made up of correlated traits. Two-factor models were constructed to assess psychopathic traits within

community samples, including the Levenson Self-Report Psychopathy Scale (LSRP), the Personality Assessment Inventory (PAI), and the Psychopathic Personality Inventory (PPI-SF). In using such models and scales, researchers study psychopathy as a two-factor construct with each factor representing distinct personality and behavioral features. Factor one, often called interpersonal/affective, and factor two, frequently identified as antisocial, have an average intercorrelation of .50 across studies (Harpur et al.,1988). For this study, in particular, it is necessary for the researchers to select a self-report scale that can provide a score for the primary factor that, as discussed below, represents the interpersonal and emotional aspect of psychopathy.

A frequently used instrument, based on the two-factor model, is the LSRP, a twenty-six item self-report scale developed to study psychopathy with noninstitutionalized samples (Levenson et al., 1995). Since publication, there has been an abundance of researchers finding correlations between the LSRP and psychopathy (as measured by the PCL-R) thereby supporting the scale's use in psychopathy research (Kelsey et al., 2014; Garofalo et al., 2018; Tsang et al., 2018). An advantage to using the LSRP to assess individual differences in a community population is that there is no explicit reference to antisocial behavior; this, as a result, has made it more useful and reliable in studying antisocial behavior without there being contamination of the results due to differentiating characteristics (e.g., criterion differences, skewed data as a result of a community population; Garofalo et al., 2019). This indirect reference to antisocial behavior prevents excessively skewed data in community samples due to negligible variation of these behaviors (Garofalo et al., 2018). In addition to this, studies show that the LSRP is more apt and effective in differentiating and studying the primary, or interpersonal/affective, factor of

psychopathy (Garofalo et al., 2018). The division of the latent factors and an emphasis on primary psychopathy, as stated above, are significant components for this current paper; as such, the selection of a measure with added emphasis or a more accurate depiction of primary psychopathy characteristics is warranted.

The PAI and PPI-SF are additional designs that examine psychopathy based on a two-factor approach. The PAI is a multiscale, in particular, eleven scale self-report instrument that is designed in such a way as to analyze a myriad of psychopathological constructs (Morey, 1991). The Antisocial Features Scale (ANT) pertains to items representing antisocial behaviors, criminality, and psychopathy (Morey, 1991). Among an offending population, the PAI-ANT was positively associated with the total PCL-R score, this however, was qualified insofar that the scores pertained mostly to the antisocial and lifestyle factor (Tsang et al., 2018). With this in mind, the PAI-ANT's emphasized placement on the secondary latent factors is not considered prudent for this study in which the researchers are directing more attention to the interpersonal attributes of psychopathy. Constructed by Lilienfeld (1990), the PPI was, again, constructed in such a way as to examine psychopathy characteristics in nonclinical samples. The PPI is a one-hundred-and-eighty-seven (187) self-report measures assessing eight factor-analytically developed domains (Lilienfeld, 1990). By further analysis, an abbreviated, fifty-six (56) item (PPI-SF) was constructed that demonstrated that the eight domains could be combined into two higher-order dimensions (Lilienfeld, 1990). The two-factor structure of the PPI-SF, however, have not always been consistent, there are concerns that have been raised regarding the item selection process and that latent traits of the PCL-R may be underrepresented (Lilienfeld, 1990; Wilson et al., 2011; Benning et al., 2003; Smith et al., 2011). With this, issuing participants with

an extensive psychopathic measure, along with additional batteries used for the purposes of this research, seemed unfeasible and unwarranted.

Collectively, two-factor models were constructed to provide more effective measures to study psychopathy outside of the criminal justice system. There is consistent evidence to suggest that psychopathic traits are distributed within a healthy and non-institutionalized community sample (Salekin, 2016; Lilienfeld et al., 2014; Garofalo et al., 2018); as such, self-report comparisons to the PCL-R is essential. The assessment and scoring of the PCL-R requires extensive training, a thorough interview with the participant(s), obtaining supplementary information from collaterals, and clinical experience (Garofalo et al., 2018). Due to such time-invested requirements, two-factor models of psychopathy may be administered to situations (e.g., college students) in which issuing the PCL-R is impractical and ultimately, unfeasible.

As previously mentioned, the PCL model of psychopathy is composed of one latent entity that is subsequently constructed via the identification of two correlated traits. Each factor represents distinct personality and behavioral characteristics: factor one, frequently called interpersonal/affective, and factor two, commonly referred to as antisocial. For example, factor one encompasses a vast number of personality traits that most researchers consider to be at the core of psychopathy (Harpur et al., 1989; Kreis et al., 2012; Miller, & Lynam, 2001). In the LSRP, interpersonal/affective items concern emotional impressions and one's interpersonal processes and ability (Vaidyanathan et al., 2011). Such items are characterized by superficial charm, narcissism, grandiose sense of self-worth, habitual and pathological lying, lack of sincerity, lack of affect and emotional depth, callousness and lack of empathy, and failure to take responsibility for personal actions (Hare et al., 1990). Factor two, although correlated with the

latter factor, has personality traits that make it distinct, including impulsivity and antisocial behaviors (Dawel et al., 2019). Factor two comprises of general antisocial deviance, to include, low frustration tolerance, a parasitic lifestyle, impulsivity, early behavioral problems, juvenile delinquency, general irresponsible behavior, proneness to committing many criminal offenses, and a high probability of criminal recidivism (Hare et al., 1990).

Of particular interest for this paper is the notion of shallow affect, which is one of the traits associated with primary psychopathy (Marsh, 2013; Murrie et al., 2012). Otherwise known as blunted or constricted affect, this feature is considered a type of negative symptom which also appears in several psychiatric disorders (Strauss & Cohen, 2017). Blunted affect can present as a reduction in the typical outward expression of emotions in a number of distinct ways: facial expression, vocal expression, or body gestures (Strauss and Cohen, 2017). While there has been a large body of research on the experience of emotion in psychopathy, primarily regarding fear, there is relatively little research that examines blunted emotional expression. A better understanding of the basis, features, and moderators of blunted expressed affect will contribute important novel information to existing knowledge regarding the personality construct of psychopathy. For example, the current study will examine blunted affect as it pertains to a possible disconnect between one's internal emotional reaction to a positively or negatively-charged stimuli. With this, the study of potential mediators or the amalgamation of mediators to explain the disconnect is pertinent to study.

Scientists have thoroughly researched autonomic nervous system arousal responses, which reflect subjective emotional experience, to fear stimuli in relation to psychopathy (Cleckley, 1941; Hoppenbrouwers et al., 2016; Fanti et al., 2017; Benning et al., 2005;

Vaidyanathan et al., 2011). These studies consistently find that individuals scoring higher than controls on psychopathic measures tend to show blunted physiological arousal to fear stimuli (Thomson et al., 2019). Such findings have been based on a wide range of measures of autonomic activity (e.g., skin conductance, heart rate, eye blink startle-reflex, pupillometry). The physiological arousal to emotionally-aversive stimuli seems to show an inverse relationship between primary and secondary psychopathy. For example, Patrick (1994) documented that reductions in emotional reactivity are found almost exclusively in individuals with relatively high scores on factor 1. The "antisocial behavior" component is correlated with fearfulness, emotional dysregulation, and higher levels of distress (Patrick, 1994). Consistent with such findings, a meta-analysis conducted by Lorber (2004) recorded an inverse relationship between facets while using skin conductance measures. Reduced physiological responses to threat stimuli in individuals scoring high on factor two has been sporadically found or ubiquitously absent (Lorber, 2004; Kyranides et al., 2017; Fanti et al., 2017; López et al., 2013). Such results also provide underlying support for psychopathy to be viewed as a dichotomous construct as opposed to a single taxon.

Regarding emotional experience (e.g., autonomic reactivity and subjective-reports of emotional experience) and emotional expression (e.g., facial responsiveness), the prevailing model of emotion uses valence and arousal dimensions to categorize and measure features of different emotions (Russell, 1980; Russell & Barret; 1999; Nummenmaa & Tuominen, 2018). Valence refers to the subjective appraisal of emotion-evoking stimuli on a bipolar unpleasant to pleasant scale (Russell and Barret; 1999; Nummenmaa & Tuominen, 2018). Analogous to valence, arousal refers to a continuous dimension in which it relates to the intensity of

experienced emotions from low to high (Russell, 1980; 1999; Nummenmaa & Tuominen, 2018). Using this model, emotions can be placed on a particular quadrant with distinguishing underlying features. For example, surprise has a relatively neutral valence with high arousal, whereas disgust has negative valence and low arousal (Jääskeläinen, 2019).

The literature is relatively consistent that decreased fear relates to primary psychopathy, while increased fear relates to secondary psychopathy. However, the inherent emotional experience of individuals scoring high on psychopathic measures in response to stimuli evoking emotions other than fear remains a point of contention (e.g., happiness, sadness, anger). For example, when told to anticipate emotionally-arousing images, Blair et al. (1997) found that individuals with psychopathic traits, as measured by the PCL-R, when compared to their non-psychopathic counterparts, had reduced autonomic responses to distressing stimuli (e.g., pictures of a group of crying adults, a screaming boy holding onto a railing). Other studies reported that individuals with psychopathy, divided into groups (e.g., high psychopathic scores, low psychopathic scores, and a mixed group) and examined based on a two-factor model, showed reduced autonomic responses across all emotion categories of pictures that were presented (Kilmonis et al., 2017; Patrick et al., 1993; Burley et al., 2017; Levenston et al., 2000; Herpetz et al., 2001). This is consistent with Hare's descriptions that individuals with psychopathy do not sufficiently process emotionally evocative stimuli and events (1970). In contrast to these replicated findings, one study found that psychopathic individuals, whether studied by primary or secondary psychopathy or as a unitary model, had an increase, rather than decrease, in autonomic arousal to both pleasant and unpleasant stimuli relative to neutral stimuli (Carmen Pastor et al.,

2003). In contrast to previous studies, this study separated primary and secondary psychopathy and found that both displayed an increase in physiological arousal (Carmen Pastor et al., 2003).

Researchers sometimes measure subjective emotional experience related to psychopathy with self-report scales rather than physiological measures. Patrick et al. (1993) found that individuals with psychopathy reported normal levels of experience to emotionally-evocative images, equal to the experience of the healthy control group. As opposed to neutral images, people with high scores on psychopathy, whether primary or secondary, rate pictures just as pleasing or as negative as that of a healthy sample (Carmen Pastor et al., 2003; Verona et al., 2004). Similar to physiological devices designed to measure emotional experience, self-report scales indicate that both individuals with high total psychopathy and dimensional scores, and healthy controls find emotional pictures more arousing than neutral ones (Carmen Pastor et al., 2003; Verona et al., 2004, Patrick et al., 1993).

There has been relatively less research conducted on the relationship of level of blunted emotional expressiveness and psychopathy. Researchers generally agree that individuals with a psychopathic personality have constricted expressed affect (Hare, 1970; Marsh, 2013; Rimé, 1978). Facial electromyography (EMG) is sometimes used as a method to examine the amount of facial expression. Changes in facial EMG over the corrugator muscles is associated with negatively-valenced expressions, while EMG changes over the zygomatic muscles is linked to positively-valenced expressions (Van Boxtel, 2010). In one of the few studies on this topic, Fanti et al. (2016) found that adolescents who scored higher on callous-unemotional (CU) traits (i.e., primary psychopathy) showed reduced facial electromyography voltage at the corrugator muscle (i.e., less negative facial expression) in response to videos representing all valence categories

(i.e., violent scenes, comedy scenes, and neutral scenes). Fanti et al. (2016) considered the role of the zygomatic muscle and showed that compared to a healthy control group, adolescents scoring higher on CU traits showed limited facial responses to presented stimuli. Deficits in the emotional expression of psychopathic individuals are further substantiated by De Wied et al. (2012), which found that adolescents scoring high on CU traits showed reduced zygomatic and corrugator muscle responses to emotionally-evocative stimuli. Reduced facial expression in people with high levels of general psychopathy, and not subtypes, has also been reported in an additional study in which researchers found a diminished facial expression to picture and facial stimuli (Hagenmuller et al., 2012).

Although there is a theory that individuals scoring high on measures of psychopathy have diminished emotional expression, there are research findings that challenge this idea. For example, in one study there was no difference in how a healthy sample and people with psychopathy responded in their facial expression to different forms of emotions (i.e., anger, happiness, and sadness) conveyed to them by pictures (Künecke et al., 2018). De Wied et al. (2006) found that younger individuals, when scoring higher on CU scales, showed less facial mimicry in response to viewing only angry facial expressions. Herpetz et al. (2001) found that individuals with psychopathy exhibited less facial expressivity to both positive and negative emotionally-arousing valence images. This lack of expressivity may be a natural automated result of reduced internal emotional experience in response to emotionally-valanced stimuli. Alternatively, the relationship between emotional experience and emotional expression may be decoupled, with reduced expression relative to internal experience. Theoretically, this may result

from one of more moderators (i.e., primary psychopathy, secondary psychopathy, executive functioning, or expression suppression), as discussed below.

As mentioned above, one theory to explain decoupling of emotional experience and expressivity is that individuals with reduced executive functioning ability may experience a disconnect between inner experience and an outward expression of emotion (Cohen et al., 2012). That is, due to a lower capacity of utilizing cognitive resources in the moment, the motor response responsible for creating an outward expression of emotion is inhibited. In this model, the subjective experience of the emotion is relatively intact, but the expression of that emotion is blunted by the reduced cognitive capacity (Cohen et al., 2012). This theory was supported by data showing that schizotypal participants, when compared to their baseline, had expressivity reductions when engaged in executive functioning tasks, in particular, working memory tasks (Cohen, 2012). To date, it does not appear that there is an existing body of research that has directly examined this model in relation to psychopathy. In addition, there does not appear to be research with individuals scoring high on psychopathy measures that examines whether such executive abilities moderate the relationship of emotional experience (e.g., autonomic reactivity) to outward emotional expression (e.g., facial expression).

Psychopathy has universally been recognized as a unitary syndrome in which an individual is proposed as having, as mentioned above, a confluence of distinct traits, which historically included having above-average intelligence compared to their non-psychopathic counterparts (Cleckley, 1941). With this in mind, there has been a general agreement that deficits associated with PCL-R factor one scores of psychopathy were the consequence of a central emotional deficiency insofar that physiological responses and emotional expression were

presumably not a result of reduced cognitive ability (Hare, 1970; Levenston et al., 2000). Both ideas, however, have come under scrutiny in recent years due to ongoing research exploring cognitive abilities in people with high scores on psychopathy measures (Dvorak-Bertscha et al., 2009). There is burgeoning evidence that reduced executive functioning ability mediates the relationship involved in affective response to stimuli and psychopathy. Specifically, research has found that individuals with relatively higher levels of psychopathy scores and lower executive functioning capabilities show decreased affective response to emotionally-evocative stimuli (Simpson et al., 2001; Hariri et al.,2003; Dvorak- Bertscha et al., 2009, Curtin et al., 2001). Another study found that higher scores on primary psychopathy but with lower levels of intelligence elicit reduced autonomic reactivity to evocative images (Bate et al., 2014). Research findings relating to executive functioning may explain a competing theory insofar that cognitive functioning may mediate the relation, in which there is intact arousal experience but a lower outward expression of emotion.

Research has further detailed the relationship between psychopathy and reduced executive functioning performance, including working memory. The role of working memory has been comparable to the above phenomena, less explored, and equivocal (Brazil et al., 2013, Delfin et al., 2018; Sadeh & Verona, 2008; Hansen et al., 2007; Hoppenbrouwers, 2015). Working memory is considered a subtype of executive functioning whereby it refers to the active and top-down manipulation of information that is held in short-term memory (Nee et al., 2013). This subtype of executive functioning is a limited capacity portion of the human memory system that integrates the temporary storage and subsequent manipulation of information to help facilitate the cognition process (Nee et al., 2013). In a systematic review conducted by Brazil et

al. (2013), across four aspects of executive functioning aspects (working memory, planning, attention, and inhibition), there were no consistent and significant relationships between performance and psychopathy scores. Delfin et al. (2018) found that working memory deficits were prevalent in only individuals scoring higher on secondary psychopathy, whereas Bagshaw et al. (2014) found that greater deficits in executive functioning, including working memory are also correlated with the affective (i.e., primary) component of psychopathy.

Hoppenbrouwers et al. (2015) found that primary psychopathic traits are associated with deficits in top-down incorporation of contextual information and are associated with response modulation problems. Other research found that when examining primary and secondary factors, individuals scoring higher in primary psychopathy, but not consistently secondary psychopathy, show deficiencies in response reversal, reversal learning, decision making, attention, planning, and inhibitory control (Baliousis et al., 2019, Mitchell, 2015; De Brito et al., 2013; Rita et al., 2018; Rolls, 2004; Zeier et al., 2012; Krakowski et al., 2015; Bagshaw et al., 2014; Kim & Jung, 2014). Although there is support for executive functioning deficits in psychopathy, other researchers have found no difference in executive functioning performance and working memory, and psychopathy when compared to healthy participants (Hare, 1984; Hare et al., 1990, Brazil et al., 2013). The equivocal findings listed above, may have varied due to an inconsistent way to explain and measure psychopathic subtypes (i.e., primary and secondary) and to examine one's intelligence and executive functioning.

As previously mentioned, emotional deficits are integral to the construct of psychopathy and empirical evidence suggests that individuals with psychopathy have reduced emotional expression (Patrick, 1994; Hare, 2003). Despite the burgeoning literature, the mechanisms that

underlie the blunted affect remain elusive. Beyond cognitive capacity or cognitive capabilities, an additional theory for the disconnect between emotional experience and emotional expression is that individuals with psychopathy suppress the expression of their emotion more frequently than average (Nentjes et al., 2016). Individuals in the general population vary in the use and ability to intentionally suppress expression of emotion through facial expressions, vocal acoustics, and body movements/posture. This type of intentional suppression has been shown to reduce internal experience of positive emotions and increase experience of negative emotions in non-psychiatric participants (Gross & John, 2003). As expression suppression is volitional, this would theoretically result in an intact experience of emotion with a relative reduction in the external expression of that emotion, causing a decoupling of experience and expression.

While there does not appear to be research on emotion suppression and psychopathy, increased emotion suppression has been found to relate to other forms of psychopathology such as Borderline Personality Disorder, Depression, Anxiety Disorders, and eating and substance related disorders (Carpenter & Trull, 2013; Aldao et al., 2010; DiMaggoi et al., 2017). Although there does not appear to be research pertaining to emotion suppression in psychopathy, researchers have found that greater severity of primary psychopathy relates to a reduction in more broadly defined healthy emotional regulation strategies (Garolfalo et al., 2018). With this, there is reason to believe that individuals with primary psychopathy may engage in more frequent use of unhealthy regulation strategies such as volitional suppression of experienced emotion.

The findings above suggest value in a novel investigation of the potential for severity of primary and secondary psychopathy, executive functioning ability, and use of emotional

expression suppression to result in decoupling of emotional experience and expression. A better understanding of the associations between psychopathy and internal versus external emotional reactivity will help refine assessment and treatment of individuals presenting to clinical settings with a high level of psychopathy. For example, if a person high in psychopathy lacks expression of emotion but has an intact emotional experience, this could direct a clinician to use social skills training to increase expression to be commensurate with internal experience. This, in turn would theoretically, increase social functioning, which relies on accurate expression of internal emotion cues when interacting with others.

Considering existing empirical evidence, it is reasonable to predict three possible models that may explain reduced affect in primary psychopathy or psychopathy universally. One model is that individuals with primary psychopathy display blunted expressed affect due to reduced cognitive resources (e.g., working memory), overwhelming the successful operation of internal experience to evoke an external emotional expression. A second model is that individuals with higher primary and/or secondary psychopathy scores show more frequent use of volitional expression suppression, leading to a disconnect between experiencing emotion and expressing an appropriate presentation of emotion. However, this model is exploratory due to the lack of existing research to inform this hypothesis. A third model is that individuals scoring higher on primary psychopathy have a reduced internal emotional experience, which would directly cause reduced expression without volitional intent. Therefore, the aim of the current study is to examine these competing models in a sample of undergraduate students who vary on dimensions of primary and secondary psychopathy scores.

Hypotheses:

1) Hypothesis #1: Individuals who score higher on primary, but not secondary, psychopathy will show reduced performance on a visuospatial working memory task.
2) Hypothesis #2: Individuals who score higher in primary, but not secondary, psychopathy will report increased daily volitional expression suppression.
3) Hypothesis #3: Independent of psychopathy scores, visuospatial working memory performance will moderate the relationship between internal emotional experience and automatic expression. Specifically, individuals with lower working memory performance will report reduced automatic expression relative to their internal experience.
4) Hypothesis #4: Independent of psychopathy scores, the degree of daily volitional expression suppression will moderate the relationship between emotional experience and expression. Specifically, individuals reporting increased daily expression suppression will show reduced expression relative to their experience.
5) Hypothesis 5: Primary, but not secondary, psychopathy scores will moderate the relationship between emotional experience and automatic expression in the direction that individuals with higher primary psychopathy scores will report reduced automatic emotional expression relative to their internal experience.
6) Hypothesis 6: There will be a three-way interaction between the moderators of primary psychopathy scores, visuospatial working memory performance, and degree of daily use of volitional expression suppression on moderating the relationship between internal emotional experience and expression. Specifically, individuals with a combination of higher primary psychopathy scores, lower working memory scores, and higher scores of

volitional expression suppression will show the largest reduction of emotional expression relative to their internal experience.

METHODS

Participants

Participants were undergraduate students enrolled in a Psychology course at the University of Central Florida who received course credit for participation through the Sona Systems portal. Students were required to be at least eighteen years or older to complete the study. An initial sample of 236 participants completed a portion of the study. Seventy of these participants were excluded because they either did not finish the n-back task or stated that we should not use their data on the SRASQ (see Measures below). Participants were then excluded based on a probability that they were "button-pressing" throughout working memory testing, wherein, it is reasonable to believe that participants were seemingly equally as likely to press a button to a given stimulus if it is a correct or incorrect response (defined as false alarms > hits for either the one or two back condition; $n = 20$). Participants who completed the study too quickly (i.e., < 10^{th} percentile in duration compared to entire sample) were excluded for high likelihood of inadequate attention to item content ($n = 15$). For this reason, one participant was excluded as a result of pressing too little on the 1-back task (i.e., $Z < -3.00$ – false alarms + hits). Two participants were subsequently removed on the 2-back task for comparable reasons, wherein zero were noted for such issues on the 3-back. Responses to two validity scales were utilized to exclude further participants (see Measures section for description of the validity scales). One participant was removed after endorsing two infrequency questions incorrectly. One additional participant was removed as a statistical outlier (see Statistical Analysis section below).

Following these exclusions, 126 participants remained in the final analysis (mean age = 19.60 (SD = 4.51); range: 18 to 49; 62.7% women). For race, 70.6% (n = 89) endorsed "Caucasian/White," 10.3% (n = 13) "Mixed (substantial mixture of above)," 8.7% (n = 11) "Asian," 6.3% (n = 8) "African American/Black," 3.2% (n = 4) "Other", and 0.8% (n = 1) "American Indian or Alaskan Native." Separate from race, 24.6% (n = 31) endorsed an ethnicity of "Hispanic/Latino(a)."

A sensitivity power analysis was conducted using G*Power (Version 3.1.9.6) assuming use of linear multiple regression with a fixed model examining change in R^2, with 14 predictors of interest (includes all interactions) and two covariates. Assuming a two-tailed alpha of .05, power = .80, and 126 final participants, results showed that we had power to detect medium and large effect sizes of $f^2 > .15$

Measures

Validity Scale #1: The Abbreviated Marlow-Crowne Social Desirability Scale (MCSDS; Reynolds, 1982). This thirteen-item true/false short form was used to exclude participants who are unwilling to endorse minor personal shortcomings that are common in the general population (Reynolds, 1982). Participants who score higher than two standard deviations above the mean of the entire sample were excluded from the final data analysis to reduce the likelihood of socially desirable responding on the measures of interest.

Validity Scale #2: Insufficient Effort Responding Infrequency Scale (IERIS). This scale contains eight highly-improbable events (e.g., "I eat cement occasionally.;" I have never used a computer.;" Huang et al., 2015). Participants who endorsed two or more items incorrectly were

excluded due to the likelihood of poor attention to item content across all measures. Pairs of the eight items were placed in between other scales of interest.

Validity Scale #3: Self-Report of Attention to study Questions (SRASQ). Following completion of all study measures, the participants were asked a question. The students inputted a response to indicate whether the researchers of this study should use their data. The wording of this measure was slightly modified from Meade and Craig (2012): "Lastly, it is vital to our study that we only include responses from people that devoted their full attention to this study. Otherwise years of effort (the researchers and the time of other participants) could be wasted. Often there are several distractions present during online studies (e.g., other people, television, music). You will receive credit for this study no matter what. In your honest opinion, should we use your data in our analyses in this study? YES/NO. We appreciate your honesty!" According to Meade and Craig (2012), approximately ten percent of participants will answer "no" which was highly predictive of other validity problems in their study. Therefore, we excluded all participants who responded with "no" to this question.

Levenson Self-Report Psychopathy Measure (LSRP). Psychopathy was measured using the LSRP, a 26-item self-report scale originally constructed with a college student sample and widely used in non-institutionalized samples (Levenson et al., 1995; Garofalo, 2019). The items are rated on a four-choice Likert scale ranging from "Strongly Disagree" to "Strongly Agree" and include attributes that prompt trait-like rather than state responses. The LSRP produces two subscales for the severity of primary and secondary psychopathy, with higher scores demonstrating greater severity. A substantial number of studies have upheld the construct validity and reliability of this two-factor model and the advantages of studying psychopathy

using a dimensional approach rather than categorically (e.g., Miller et al., 2008; Friedman et al., 2018; Garofalo et al., 2019; Salekin et al., 2014; Book et al., 2007; Brinkley et al., 2001). Also, researchers suggest that a two-factor dimensional approach to psychopathy appears to demonstrate greater convergent and discriminant validity as opposed to psychopathy studied as a general category (Tsang et al., 2018; Salekin et al., 2014). The two scores for primary and secondary psychopathy severity were used in the regressions.

Positive and Negative Affect Schedule-Expanded Form (PANAS-X). Emotional experience was measured using the PANAS-X, a measure designed to describe different feelings and emotions. This measure involves sixty words and phrases scored on a 1 (very likely or not at all) to 5 (extremely) Likert Scale. Participants were asked to indicate how much they feel certain emotions (e.g., happiness, sadness, anxiousness, etc.) at specified intervals of time (Watson & Clark, 1994). For this study, the researchers modified the directions to ask participants how they typically felt over the past year. This modification to a period of time was analogous to the frequency of time asked in other measures. The internal consistency and convergent and discriminant validities of both positive and negative affect are high (Costa et al., 2020). An average item score across all positive valence items (PANAS_POS) and separately for negative valence items (PANAS_NEG) were used in the regressions.

Berkeley Expressivity Questionnaire (BEQ): Gross and John (1995) conceptualized emotional expressivity as a constant trait, and developed a short, self-report questionnaire to examine it. For the purpose of this study and to be consistent with the time period of the PANAS-X, the instructions were customized to ask participant to respond according to what they experienced over the past year. The BEQ comprises sixteen items and three subscales (positive expressivity,

negative expressivity, and impulsivity). Impulsivity, originally termed impulse strength, refers to the strong emotional reactions that are analogous to the experience of physical changes that participants are unable to prevent or subdue (Gross & John, 1995). Responses are scored using a seven-point Likert scale, ranging from 1 (strongly disagree) to 7 (strongly agree). The average score of each subscale is calculated to measure the salience of each component, whereas general expressivity is measured by averaging all subscale scores. The full-scale and subscale scores assess both the potency of emotional response tendencies and the degree that they are expressed behaviorally (Lin et al., 2015). The full scales and subscale scores have been shown to maintain internal consistency, reliability, and validity scores among distinct samples (Gross & John, 1995; Lin et al., 2015). The subscales of positive expressivity (BES_POS) and negative expressivity (BES_NEG) were used in the regressions.

Emotion Experience and Expressive Suppression Scale (EEES; Bedwell et al., 2019). Emotional suppression was measured using the EEES, a 14-item self-report measure of emotional experience and suppression of expression. Participants were asked to respond to two questions ("In the past year, how often have you felt this way?" and "Generally, when you feel this way, do you tend to show or hide the way you feel?". Participants received a list of seven emotion type prompts and, for each, responded to the two questions using a seven-point Likert scale. The EEES assesses a variety of positive and negative emotions ("hostility-angry, hostile"; "guilt-guilty, ashamed;" "sadness-sad, lonely;" "joviality-happy, excited;" "self-assurance-proud, confident;" and "attentiveness-alert, attentive") and the frequency of suppressing expressions of emotions. For this study, only the responses from the seven suppression questions (i.e., …tend to show or hide…) were used, and subscales for average item scores for positively valanced

emotions (EEES_POS) and negatively valanced emotions (EEES_NEG) were used in the regressions.

Visuospatial Working Memory Task ("n-back task"). Kirchner (1958) developed a continuous performance task to measure visuospatial working memory, which has since been called a type of "n-back" task. Various versions of the n-back task have been frequently used over time to measure individual differences in working memory performance. The current study used a particular visuospatial version of the n-back that was published on pavlovia.org which was modeled after the original task. Participants were asked to monitor a series of squares appearing randomly in one of eight potential locations and to press a keyboard button if a given square was presented at the same location as the one presented *N* trials ago, where *N* is a predefined integer. The *N* typically ranges between one and three, wherein the higher the number (i.e., 3-back), the more challenging the task is for participants (Schwippel et al., 2018; see Figure 1, p. 69 for depiction of the task). This spatial n-back task was programmed with PsychoPy Version 1.83.04 (Pierce, 2007).

The n-back test used in this study mirrored the procedures and methods outlined in Schwippel et al.'s (2018) study. The test was presented in sequential order of *N* conditions, starting with 1-back and ending with the 3-back and the inter-stimulus interval occurred as a blank screen for 2.5 seconds between each stimulus. Twenty-five percent of the stimuli presented, at random, were correct targets (i.e., in the same location as n-trials prior). Each condition (*N*) lasted approximately six minutes, with a pause of sixty seconds in between. Following instructions, each condition contained 120 trials of a blue square randomly appearing for 500 ms in one of eight positions in a square configuration around a central fixation cross.

Participants were asked to push the spacebar on their keyboard as fast as possible upon observing the correct target. Participants were instructed to not respond when a target is not in the same location as n-trials prior. The discriminability index *d*' (*d*-prime), based upon signal detection theory, was calculated by using the formula *d*' = *Z*(hit rate) − *Z*(false alarm rate; Stanislaw and Todorov, 1999). This is a type of accuracy that accounts for both specificity (i.e., false alarms) and sensitivity (i.e., hit rate) to presented stimuli (Stanislaw and Todorov, 1999). The n-back task requires a multitude of cognitive processes; for example, the tasks measure one's ability to encode and temporarily store each stimulus and continuously update the information of incoming stimuli (Gajewski, 2018). The n-back tasks thus are an efficient method to assess individual differences in working memory performance (Gajewski, 2018). The primary analyses will use the average *d'* across the 2- and 3-back conditions (nback_d_av).

Procedures

The entire study was administered online. Each individual initiated participation using the Sona Systems portal, which stated that they must complete using a keyboard in order to participate. The participants were transferred to the Qualtrics website for the study which began with an informed consent statement. If the participant elected to participate, they began by completing demographic questions. Following this, participants completed each of the scales listed in the Measures section above, in consecutive order. Pairs of the eight infrequency scale items were placed in between other scales. Participants were then transferred to the Pavlovia.org website which hosted the n-back task. After completing the working memory task, participants completed the SRASQ validity measure and viewed an informational form that explained the

study more in-depth. The completion of the study was then communicated by Pavlovia to Sona Systems so that the participants received the academic credit.

Statistical Analysis

All of the final 126 participants had scores on all variables in the analysis. Each variable was examined for statistical outliers using the criteria of a *Z* score over ± 3.00. These resulting Z scores were then used in all analyses for ease of interpretation when comparing scales. The initial two hypotheses were examined with independent linear regressions, covarying for age and biological sex. The remaining hypotheses were then examined using hierarchical linear regressions with the dependent continuous variable of BEQ scores (i.e., self-reported emotional expression), and the five predictors of primary psychopathy scores, secondary psychopathy scores, emotion expression suppression scores (EEES), emotional experience scores (PANAS), and visuospatial working memory performance (*d*' from n-back task) – along with two-, three-, and four-way interactions among them, and including age and sex in Block 1. Two of the hierarchical regressions were conducted, one using positive valance scores for the BEQ, EEES, and PANAS, and the other using the negative valence scores from those measures. Hypotheses 3 to 6 were addressed through examining interactions of the PANAS and other predictors in the prediction of BEQ scores. Any statistically significant interactions were then examined through the simple effects for interpretation.

RESULTS

Across participants, all variables of interest showed relatively normal distributions. Examination for statistical outliers on variables of interest revealed one participant who was excluded for the PANAS_TOT variable, resulting in the final 126 participants. See Table 1 for descriptive statistics and Table 2 for zero-order Pearson correlations.

To address hypothesis #1, a linear regression was used to enter age and sex in the null model followed by predictors of primary and secondary psychopathy severity on the dependent variable of average n-back score. This regression found that, as predicted, primary psychopathy severity showed a negative relationship with performance on the n-back (B = -.29, p = .005; see Figure 2, p. 70), while there was no relationship with secondary psychopathy severity (B = .12, p = .22).

To address hypothesis #2, the same type of linear regression was used, but two were examined – one with the DV of level of suppression of positive emotions and the other with the DV of level of suppression of negative emotions. For positive emotions, neither primary (B = -.10, p = .34) or secondary (B = .15, p = .12) psychopathy related to level of suppression. There was a similar lack of relationship with suppression of negative emotions for primary (B = -.005, p = .96) and secondary (B = .01, p = .91) psychopathology severity.

To address the remaining hypotheses, we conducted two additional regressions, one for positive emotions and one for negative emotions. See Table 3 (p. 58) for the regression statistics for positive emotions. Age did not relate to expression for either positive or negative expressivity, but sex showed a main effect such that women reported a greater degree of

expressing positive emotions than men. There was a positive main effect for experience of emotion (PANAS_POS) and a negative relationship for degree of suppression (EEES_POS), both on strength of expression (BEQ_POS). However, there were no significant interactions in the model. Therefore, there was no support for hypotheses three through six in the model using positive emotions.

See Table 4 (p. 60) for the regression statistics for negative emotions. For this model, hypotheses three through five were not supported. However, we found support for hypothesis 6 through a statistically significant four-way interaction. This interaction included primary psychopathy severity, working memory performance (nback_d_av), degree of volitional expression suppression (EEES_NEG), and internal emotional experience (PANAS_NEG) in predicting emotional expression (BEQ_NEG) in regard to negative emotions. The second four-way interaction that accounted for secondary, rather than primary, psychopathy scores was not statistically significant.

We then examined the simple effects of the significant four-way interaction from the negative emotion regression. At the initial level, we used a median split to create subgroups with low and high primary psychopathy scores. There were no significant interactions with variables included in the low primary psychopathy group model. Thus, the use of the subgroup with low primary psychopathy scores was discontinued from further examination (see Table 5, p. 63). For the high primary psychopathy subgroup, a significant two-way interaction was found for experience of negative emotions (PANAS_NEG) and the use of emotional suppression (EEES_NEG) in predicting emotional expression (BEQ_NEG; see Table 6, p. 65). While the three-way interaction that included n-back performance was not statistically significant, the n-

back variable was retained as a covariate in remaining simple effects as it was a part of the initial significant four-way interaction.

Further analysis of the subgroup with high psychopathy scores was conducted, wherein we created a median split to create subgroups scoring low and high in the use of volitional emotion suppression (EEES_NEG). There was no signification relationship between the PANAS_NEG and BEQ_NEG for the subgroup with high primary psychopathy and low emotion suppression (see Table 7, p. 67). In the subgroup with high primary psychopathy and high volitional emotion suppression (EEES_NEG), we found a significant negative relationship between experience of negative emotions (PANAS_NEG) and emotion expression (BEQ_NEG; see Table 8, p. 68; and Figure 3, p. 71).

DISCUSSION

The present study aimed to examine three models that may explain or contribute to reduced expressed affect in a non-clinical sample of individuals with varying scores on a self-report measure that assessed severity of subtypes of psychopathy. The association pertaining to the first hypothesis was, as predicted, accounted for and shown to be significant, wherein as scores on primary psychopathy severity increase, there is a comparable declination or lowering of one's performance on the n-back visuo-spatial working memory test (see Figure 2, p. 70). As previously stated, a unanimous agreement on factors or severity of such factors, and an association between executive functioning scores is contentious and unresolved. In Cleckley's work (1941), the notion of psychopathy involved one who maintains superior knowledge relative to a healthy person without high levels of psychopathy. Previous research has been unable to demonstrably evince differences between the intelligence of individuals with and without psychopathy (e.g., Nee el al., 2013; Bagshaw et al., 2013). Such findings may, as a result, stem from lack of consensus on how to properly assess for levels of psychopathy, with researchers electing to utilize a myriad of assessments and examine different populations.

Recent research indicates, however, that the association between higher levels intelligence and primary psychopathy is generally weak and inconclusive (Hare & Neumann, 2008; Bate et al., 2014). In a review, Brazil et al. (2013) found inconsistent results across four aspects of executive functioning. Other researchers found executive functioning deficits in only individuals who score high severity on secondary psychopathy with no relationships between intelligence and primary psychopathy (Delfin et al., 2018). Bagshaw et al. (2014) noted larger

deficits in executive functioning as related to primary and total psychopathy alike. Bagshaw et al. (2014) found that, while using the PCL-R two-factor approach, primary psychopathy was more negatively associated with planning time, response inhibition, and inadequate set-shifting; in Delfin et al. (2018), however, findings were contrary. This may stem from the participants used, wherein Delfin et al. used incarcerated male young offenders (age 18-25) who were convicted of hands-on violence. Bagshaw et al. (2014), while also using incarcerated offenders, they ranged in age (25-54). In addition, Delfin et al. (2018) noted that while such a pattern has emerged, results of executive functioning scores remain inconclusive. With this, it was reported that the inconclusive findings were relevant to "the broad nature of EFs [executive functioning];" wherein results are difficult to universalize (Delfin et al., 2018).

A possible reason for the association between individuals scoring high on primary psychopathy severity and lower working memory capacity pertains to the notion that attentional deficits that, while equivocal between researchers, has more recently been shown to be present in individuals scoring higher on psychopathy assessments (Hoppenbrouwers et al., 2015; Kosson & Newman, 1986; Baliousis et al., 2019). In the research conducted by Baliousis et al. (2019), individuals scoring higher on a measure of psychopathy showed reduced performance in attention and inhibitory control. Thus, for working memory tasks, assessments designed to temporarily hold and manipulate information, lack of attention to the information presented, will, result in reduced correct responses and, thus, a reduction in working memory capacity. Individuals with high primary, as opposed to secondary, psychopathy show deficiencies in response reversal, reversal learning, decision making, attention, planning, and inhibitory control (Baliousis et al., 2019, Mitchell, 2015; De Brito et al., 2013; Rita et al., 2018; Rolls, 2004; Zeier

et al., 2012; Krakowski et al., 2015; Bagshaw et al., 2014; Kim & Jung, 2014). With this, difficulties with sustained attention and visual searching may attenuate visuo-spatial working memory capacity in individuals with higher scores on primary psychopathy.

The results of this data did not corroborate the second hypothesis, wherein it was considered that individuals who score higher in primary, but not secondary psychopathy, will report increased daily volitional expression suppression. The data did not provide evidence for increased expression suppression in either dimensional aspect of psychopathy. The reasoning for the hypothesis pertained to the idea that emotional deficits are integral to the construct of psychopathy, in particular, primary psychopathy, wherein emotional expression is considered to be reduced or absent (Patrick, 1994; Hare, 2003). While it was noted that there does not appear to be research on emotional suppression relevant to psychopathy, research has previously indicated a decreased use of healthy emotional regulation strategies in individuals scoring higher on psychopathy (Garolfalo et al., 2018). With this, the volitional use of suppression of expression was considered a plausible avenue for individuals scoring high on primary psychopathy to show a disconnect to experience of emotion and subsequent expression. It is interesting to note, however, that when examining zero-order correlations among all variables, the PANAS score of experiencing negative emotion was not associated with the subsequent test, BEQ, designed to measure the expression of internally experienced emotions in our healthy sample. In particular, the zero-order correlation between the experience of negative emotions and the expression of such negative emotions were not associated. There appeared only a moderate positive association between emotional experience and emotional expression of positive emotions.

A possible reason for the absence of any findings pertaining to psychopathy's sole influence on the association between a disconnect between emotional experience and emotional expression may be as a result of the utilization of self-report assessments without corroborating or disconfirming details available from the use of physiological measures. Ellis et al. (2017) found that contrary to electrophysiological data, participants with varying degrees of psychopathy did not report experiencing blunted affect and subsequently reported more emotional reactivity when told to either volitionally suppress or to not suppress their emotions. The researcher's results indicated inconsistency between self-report questionnaires of emotional regulation and suppression and physiological data (Ellis et al., 2017). Thus, the participants may have over-estimated their emotional experience and/or expression, potentially due to lack of insight regarding subjective emotional experiences. As such, if the researchers were to use electrophysiological measures, in addition to self-report indices, results may have been different insofar that suppression of emotion was present and active in individuals scoring higher on psychopathy factors, in particular, primary psychopathy.

However, when examining the subset of participants scoring high on primary psychopathy and high on volitionally suppressing emotional expression, then a negative relationship between emotional experience of negative emotions and external emotional expression is evident (see Figure 3, p. 71). Thus, for these participants, a disconnect arises between experienced negative emotions and weaker reports of externally expressing such emotions. This is partially consistent with the researchers' last hypothesis relevant to the notion of a four-way significant interaction. The consistency stems from the finding that while working memory capacity did not result in significant moderation, high primary and high use of volitional

suppression of emotion did significantly moderate the disconnect between emotional experience and emotional expression. The role of working memory may not have contributed to the moderation, possibly due to the use of the subgroup of only those scoring high in psychopathy severity. Thus, as a subgroup, those that reported high severity of psychopathy, working memory capacity was inherently lower than other groups researched, which may have limited the range and variance in working memory scores. The significant four-way interaction was based on subscales relating to negative emotions. No such associations were present for the regression using subscales for positive emotions. In addition, secondary psychopathy severity did not show significant interactions for either emotional valence.

As relatively true for most aspects of psychopathy research, the examination and agreement on the level of emotional experience that an individual with psychopathy experiences, remains disputable (e.g., Blair et al, 1997; Kilmonis et al., 2017; Herpetz et al., 2001; Carmen Pastor et al., 2003). However, more recent research indicates that individuals who score high on psychopathy report experiencing emotions in a similar manner as healthy samples (Verona et al., 2004; Carmen Pastor et al., 2003). Thus, along with internal experience, the current data indicate that while individuals with psychopathy experience negative and positive emotions, a weakening connection resulting in reduced affect is possible as a result of utilization of volitional suppression of negative emotions. In other words, it was found that individuals who have higher experiences of negative emotions, but score higher on primary psychopathy and emotional suppression, appear to show a lower strength in expressing their internal emotional experience.

Primary psychopathy subsumes traits, such as callousness, deceit, manipulation, lack of empathy, blunted affect, and deficits in emotional processing (Brook, Brieman, & Kosson,

2013). From this exploratory research, it is possible to infer that the deficits in emotional processing and subsequently the disconnect between emotional experience and expression may pertain to the use of expression suppression as an unhealthy emotional regulation strategy. While there does not appear to be research relevant to emotion suppression in psychopathy, researchers have found that greater severity of primary psychopathy pertains to a reduction in more broadly defined healthy emotional regulation strategies (Garolfalo et al., 2018). As such, the presence of a higher use of suppression of emotion in individuals with increased reports of severity of primary psychopathy, may explain the disconnect between reported emotional experience of negative emotions and lower rates of emotional expression of negative emotions.

Participants scoring higher on secondary psychopathy did not show the effect of increased use of volitional suppression of emotional expression. This disparity seen between factors of psychopathy may arise from the inherent characteristics that each factor subsumes. In addition to the possibility of unhealthy emotional regulation strategies, the use of emotional suppression relates to affective and interpersonal characteristics, as opposed to low frustration tolerance, a parasitic lifestyle, impulsivity, and early behavioral problems reflective of secondary psychopathy (Hare et al., 1990). As such, underlying emotional deficits present in primary psychopathy are not as prevalent in those scoring higher on secondary psychopathy severity.

Limitations of this study include selection of participants and subsequently sample size. As was stated above, all of the participants who completed the study were undergraduate students enrolled in psychology courses at the University of Central Florida. This inevitably limits the scope of people who were able to participate, thus, also limiting the generalizability of the findings described above. Although surpassing the minimum number of participants needed

to detect medium effect sizes, the final sample's statistical power diminished as more moderators and covariates were added to each block, thus, reducing the initial power. Including more participants would increase the statistical power to detect smaller effect sizes. In addition to this, the study was limited insofar that the researchers only utilized self-report questionnaires to collect data. As mentioned previously, there has been documented discrepancies in findings of, for example, self-reported levels of expression suppression and physiological recorded responses; thus, possibility leading to inaccuracies in the data collected. Comparably, Brook et al. (2013) indicated that it is generally agreed that individuals with increased scores on total psychopathy exhibit behavioral, psychophysiological, and regional brain activation anomalies when processing emotion; however, their self-report of arousal did not differ from controls.

Potential improvements to this research study would include supplementing self-report responses with electrophysiological measures of emotional reactivity and automated computer-based video analysis of emotion expression. Researchers could include emotionally-valenced images or videos, or another method to invoke differentiating emotions, to capture a participants' actual response to real-time and realistic events. With this, participants will not be required to self-reflect on their emotional experience, therefore, providing potentially more accurate data for analysis. In a comparable manner, it is recommended that researchers use additional methods to assess working memory capacity and include other tasks designed to denote other forms of executive functioning.

The findings of this study could be useful for future research on psychopathy as it relates to understanding the characteristics and functioning of psychopathy. Despite the limitation of a moderate sample size and data collected in one undergraduate student sample, results suggest

that individuals who report higher severity of primary psychopathy in a healthy and non-incarcerated sample may experience reduced visuo-spatial working memory capacity. Additionally, such individuals tend to self-report a weaker strength of emotional expression relative to frequency of experience for negative emotions, with higher use of emotional suppression as a potentially statistically significant moderator. This may raise awareness in clinicians treating individuals deemed high in primary psychopathy to consider social skills training to reduce the potential negative impact of reduced negative expressivity on social interactions. A replication of this study with a larger and diverse sample is recommended for future research with the use of both self-report and physiological measures of emotional suppression/expressivity and regulation, along with including a battery of attention, visuo-spatial functioning, and executive functioning measures.

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TABLES

Table 1. Descriptive Statistics

	Mean (SD); Range	**Skewness Statistic**	**Kurtosis Statistic**
Primary Psychopathy	1.813 (.38); 1.00 to 2.75	.31	-.14
Secondary Psychopathy	1.94 (.402); 1.1 to 3.1	.35	-.04
[1]PANAS_POS	3.347 (.706); 1.5 to 4.9	-.32	-.35
[2]PANAS_NEG	2.265 (.788); 1.0 to 4.8	.69	-.02
[3]BEQ_POS	4.99 (1.195); 1.75 to 7.0	-.48	-.41
[4]BEQ_NEG	3.43 (1.112); 1.333 to 6.50	.22	-.49
[5]EEES_POS	5.114 (1.087); 1.667 to 7.0	-.93	.89
[6]EEES_NEG	2.825 (.952); 1.0 to 5.50	.27	-.26
[7]nBack_average d'	.017 (1.021); -3.218 to 2.275	-.39	.39

[1] Positive and Negative Affect Schedule-Expanded Form- Positive Emotions
[2] Positive and Negative Affect Schedule-Expanded Form- Negative Emotions
[3] Berkeley Expressivity Questionnaire- Positive Emotions
[4] Berkeley Expressivity Questionnaire- Negative Emotions
[5] Emotion Experience and Expressive Suppression Scale- Positive Emotions
[6] Emotion Experience and Expressive Suppression Scale- Negative Emotions
[7] N-Back task (working memory) - average d' from 2 and 3 back conditions

Table 2. Zero-Order Pearson Correlations

	1	2	3	4	5	6	7	8
1. Primary Psychopathy								
2. Secondary Psychopathy	.41 ***							
3. PANAS_POS [1]	-.18 *	-.45 ***						
4. PANAS_NEG [2]	-.08	.31 ***	-.15					
5. BEQ_POS [3]	-.12	-.13	.34 ***	-.05				
6. BEQ_NEG [4]	-.18 *	-.13	.04	.02	.66 ***			
7. EEES_POS [5]	-.02	-.13	.36 ***	-.16	.44 ***	.32**		
8. EEES_NEG [6]	-.12	-.05	.11	.03	.42 ***	.50 ***	.32 ***	
9. nBack_average d' [7]	-.19 *	.02	-.11	.02	-.17	-.08	-.08	.01

* p < .05, ** p < .01, *** p < .001

[1] Positive and Negative Affect Schedule-Expanded Form- Positive Emotions

[2] Positive and Negative Affect Schedule-Expanded Form- Negative Emotions

[3] Berkeley Expressivity Questionnaire- Positive Emotions

[4] Berkeley Expressivity Questionnaire- Negative Emotions

[5] Emotion Experience and Expressive Suppression Scale- Positive Emotions

[6] Emotion Experience and Expressive Suppression Scale- Negative Emotions

[7] nBack task (working memory) - average d' from 2 and 3 back conditions

Table 3. Hierarchical linear regression for subscales involving positive emotions.

n = 126	Unstandardized Beta (SE)	Standardized Beta	Sig	Change in R^2
Block 1				.080 **
Sex	.55 (.18)	.28	.01 **	
Age	01 (.02)	.06	.47	
Block 2				
nBack_Average d' [1]	-.12 (.08)	-.12	.14	.219 ***
Primary Psychopathy	-.05 (.09)	-.05	.59	
Secondary Psychopathy	.06 (.09)	.06	.56	
PANAS_POS [2]	.22 (.09)	.22	.02 *	
EEES_POS [3]	-.33 (.08)	-.33	< .001 ***	
Block 3				.023
EEES_POS * PANAS_POS	.11 (.07)	.14	.13	
Secondary Psychopathy * PANAS_POS	-.06 (.09)	-.06	.48	
Primary Psychopathy * PANAS_POS	.02 (.08)	.02	.81	
nBack_average d' * PANAS_POS	-.13 (.09)	-.12	.16	
Block 4				.012
nBack_average d' * Primary Psychopathy * PANAS_POS	-.06 (.14)	-.057	.68	
nBack_average d' * Secondary Psychopathy * PANAS_POS	-.06 (.15)	-.048	.71	
nBack_average d' * EEES_POS * PANAS_POS	-.05 (.09)	-.065	.55	

* p < .05, ** p < .01, *** p < .001

[1] nBack task (working memory) - average d' from 2 and 3 back conditions

[2] Positive and Negative Affect Schedule-Expanded Form- Positive Emotions

[3] Emotion Experience and Expressive Suppression Scale- Positive

Primary Psychopathy * EEES_POS * PANAS_POS	.06 (.09)	.006	.96	
Secondary Psychopathy * EEES_POS * PANAS_POS	-.04 (.09)	-.071	.63	
Block 5				.014
PANAS_POS * EEES_POS	.15 (.11)	.20	.17	
PANAS_POS * primarypsychopathy	.07 (.12)	.07	.58	
PANAS_POS * secondarypsychopathy	-.17 (.12)	-.17	.17	
PANAS_POS * nback_d_av	-.04 (.14)	-.04	.78	
EEES_POS * primarypsychopathy	.01 (.11)	.01	.89	
EEES_POS * secondarypsychopathy	-.08 (.17)	-.09	.62	
EEES_POS * nback_d_av	.11 (.12)	.11	.34	
primarypsychopathy * nback_d_av	.14 (.12)	.15	.22	
secondarypsychopathy * nback_d_av	-.12 (.11)	-.13	.27	
PANAS_POS * EEES_POS * primarypsychopathy	.04 (.10)	.04	.73	
PANAS_POS * EEES_POS * secondarypsychopathy	-.09 (.09)	-.15	.37	
PANAS_POS * EEES_POS * nback_d_av	-.07 (.10)	-.09	.48	
PANAS_POS * primarypsychopathy * nback_d_av	-.14 (.16)	-.13	.39	
PANAS_POS * secondarypsychopathy * nback_d_av	.01 (.16)	.01	.97	
EEES_POS * primarypsychopathy * nback_d_av	-.23 (.13)	-.23	.08	
EEES_POS * secondarypsychopathy * nback_d_av	.06 (.17)	.05	.73	
PANAS_POS * ZEEES_POS * primarypsychopathy * nback_d_av	.19 (.13)	.19	.16	
PANAS_POS * ZEEES_POS * secondarypsychopathy * nback_d_av	-.03 (.15)	-.21	.87	

Table 4 Hierarchical linear regression for subscales involving negative emotions.

***n* = 126**	**Unstandardized Beta (SE)**	**Standardized Beta**	***p***	**Change in R^2**
Block 1				
Sex	.71 (.17)	.35	< .001 ***	.144 ***
Age	.02 (.02)	.11	.19	
Block 2				.167***
nBack_Average d' [1]	-.08 (.08)	-.08	.31	
Primary Psychopathy	-.04 (.09)	-.04	.64	
Secondary Psychopathy	-.08 (.09)	-.08	.39	
PANAS_NEG [2]	.01 (.08)	.01	.89	
EEES_NEG [3]	-.44 (.08)	-.42	< .001 ***	
Block 3				.059 *
EEES_NEG * PANAS_NEG	-.23 (.08)	-.23	.01 **	
Secondary Psychopathy * PANAS_NEG	.05 (.08)	.04	.59	
Primary Psychopathy * PANAS_NEG	.03 (.07)	.04	.68	
nBack_average d' * PANAS_NEG	.11 (.08)	.09	.19	
Block 4				.030
nBack_average d' * Primary Psychopathy * PANAS_NEG	.03 (.11)	.03	.79	
nBack_average d' * Secondary Psychopathy * PANAS_NEG	-.19 (.11)	-.21	.09	

* p < .05, ** p < .01, *** p < .001

[1] nBack task (working memory) - average d' from 2 and 3 back conditions

[2] Positive and Negative Affect Schedule-Expanded Form- Negative

[3] Emotion Experience and Expressive Suppression Scale- Negative Emotions

nBack_average d' * EEES_NEG * PANAS_NEG	.03 (.11)	.02	.81	
Primary Psychopathy * EEES_NEG * PANAS_NEG	-.03 (.09)	-.03	.76	
Secondary Psychopathy * EEES_NEG * PANAS_NEG	-.11 (.12)	-.10	.33	
PANAS_NEG* EEES_NEG * nBack_d_av	.03 (.11)	.02	.81	
Block 5				0.037 *
PANAS_NEG * EEES_NEG	-.23 (.12)	-.23	.05 *	
PANAS_NEG * primarypsychopathy	-.09 (.09)	-.09	.35	
PANAS_NEG * secondarypsychopathy	.01 (.10)	.01	.92	
PANAS_NEG * nback_d_av	.19 (.09)	.17	.05 *	
EEES_NEG * primarypsychopathy	.27 (.14)	.21	.05 *	
EEES_NEG * secondarypsychopathy	-.06 (.12)	-.05	.65	
EEES_NEG * nback_d_av	-.05 (.10)	-.04	.66	
primarypsychopathy * nback_d_av	.15 (.09)	.16	.11	
secondarypsychopathy * nback_d_av	-.08 (.11)	-.09	.41	
PANAS_NEG * ZEEES_NEG * primarypsychopathy	.02 (.10)	.03	.83	
PANAS_NEG * ZEEES_NEG * secondarypsychopathy	-.09 (.13)	-.08	.46	
PANAS_NEG * ZEEES_NEG * nback_d_av	-.08 (.12)	-.06	.53	
PANAS_NEG * primarypsychopathy * nback_d_av	.09 (.12)	.09	.43	
PANAS_NEG * secondarypsychopathy * nback_d_av	-.22 (.12)	-.25	.06	
EEES_NEG * primarypsychopathy * nback_d_av	-.02 (.16)	-.01	.88	
EEES_NEG * secondarypsychopathy * nback_d_av	-.03 (.12)	-.03	.81	

PANAS_NEG * ZEEES_NEG * primarypsychopathy * nback_d_av	-.34 (.13)	-.29	.01 **
PANAS_NEG * EEES_NEG * secondarypsychopathy * nback_d_av	.23 (.14)	.20	.11

Table 5. Hierarchical regressions for individuals scoring low (based on median split) in primary psychopathy.

n = 63	**Unstandardized Beta (SE)**	**Standardized Beta**	**Sig**	**Change in R^2**
Block 1				.173**
Sex	.91 (.30)	.36	.01 **	
Age	.03 (.02)	.16	.18	
Block 2				.226***
Sex	.66 (.27)	.26	.02 *	
Age	.01 (.02)	.05	.63	
PANAS_NEG [1]	.05 (.11)	.05	.65	
nback_d_av [2]	-.13 (.11)	-.12	.24	
EEES_NEG [3]	-.54 (.12)	-.48	< .001 ***	
Block 3				.035
Sex	.59 (.28)	.23	.04 *	
Age	.01 (.02)	.04	.71	
PANAS_NEG	.00 (.11)	.01	.98	
nback_d_av	-.14 (.12)	-.13	.22	
EEES_NEG	-.51 (.13)	-.46	< .001 ***	
PANAS_NEG ✻ nback_d_av	.18 (.13)	.15	.17	
PANAS_NEG ✻ EEES_NEG	-.09 (.11)	-.09	.38	
nback_d_av ✻ EEES_NEG	.04 (.12)	.03	.77	

* p < .05, ** p < .01, *** p < .001

[1] Positive and Negative Affect Schedule-Expanded Form- Negative Emotions

[2] nBack task (working memory) - average d' from 2 and 3 back conditions

[3] Emotion Experience and Expressive Suppression Scale- Negative Emotions

Block 4			.004
Sex	.57 (.28)	.23	.05 *
Age	.01 (.02)	.04	.66
PANAS_NEG	.01 (.11)	.01	.92
nback_d_av	-.16 (.12)	-.14	.19
EEES_NEG	-.51 (.13)	-.46	< .001 ***
PANAS_NEG ✻ nback_d_av	.17 (.13)	.14	.20
PANAS_NEG ✻ EEES_NEG	-.13 (.12)	-.13	.29
nback_d_av ✻ EEES_NEG	.04 (.12)	.04	.73
PANAS_NEG * nback_d_av * EEES_NEG	.09 (.15)	.08	.53

Table 6. Hierarchical regressions for individuals scoring high (based on median split) in primary psychopathy

n = 63	Unstandardized Beta (SE)	Standardized Beta	Sig	Change in R^2
Block 1				.114 *
Sex	.55 (.21)	.32	.01 **	
Age	-.05 (.06)	-.09	.43	
Block 2				.094
Sex	.35 (.23)	.20	.14	
Age	-.03 (.06)	-.06	.49	
ZPANAS_NEG [1]	-.07 (.11)	-.07	.55	
Znback_d_av [2]	-.03 (.11)	-.04	.76	
ZEEES_NEG [3]	-.31 (.13)	-.32	.02 *	
Block 3				.119 *
Sex	.23 (.22)	.13	.31	
Age	-.01 (.06)	-.02	.85	
PANAS_NEG	.08 (.12)	.08	.52	
nback_d_av	-.03 (.10)	-.03	.78	
EEES_NEG	-.35 (.12)	-.36	.01 **	
PANAS_NEG ✻ nback_d_av	.03 (.11)	.03	.79	
PANAS_NEG ✻ EEES_NEG	-.42 (.14)	-.38	.01 **	
nback_d_av ✻ EEES_NEG	.08 (.15)	.07	.59	
Block 4				.021
Sex	.22 (.22)	.13	.33	

* p < .05, ** p < .01, *** p < .001

[1] Positive and Negative Affect Schedule-Expanded Form- Negative

[2] nBack task (working memory) - average d' from 2 and 3 back conditions

[3] Emotion Experience and Expressive Suppression Scale- Negative Emotions

Age	< .001 (.06)	-.01	.99
PANAS_NEG	.09 (.12)	.12	.4
nback_d_av	-.01 (.10)	-.02	.89
EEES_NEG	-.33 (.12)	-.34	.01 **
PANAS_NEG ✻ nback_d_av	.04 (.11)	.04	.72
PANAS_NEG ✻ EEES_NEG	-.45 (.14)	-.42	.002 **
nback_d_av ✻ EEES_NEG	.15 (.16)	.12	.33
PANAS_NEG * nback_d_av * EEES_NEG	-.18 (.14)	-.16	.20

Table 7. Regressions for individuals scoring high (based on median split) in primary psychopathy and low (based on median split) on emotional suppression

n = 37	Unstandardized Beta (SE)	Standardized Beta	Sig	Change in R^2
Block 1				.134
Sex	.66 (.29)	.35	.03 *	
Age	.06 (.15)	.07	.66	
Block 2				.018
Sex	.58 (.35)	.31	.11	
Age	.08 (.15)	.08	.59	
PANAS_NEG [1]	.15 (.20)	.13	.46	
nback_d_av [2]	.04 (.15)	.05	.79	

* p < .05, ** p < .01, *** p < .001

[1] Positive and Negative Affect Schedule-Expanded Form- Negative Emotions

[2] nBack task (working memory) - average d' from 2 and 3 back conditions

Table 8. Regressions for individuals scoring high (based on median split) in primary psychopathy and high (based on median split) on emotional suppression

n = 24	**Unstandardized Beta (SE)**	**Standardized Beta**	**Sig**	**Change in R^2**
Block 1				.073
Sex	.02 (.32)	.02	.94	
Age	-.07 (.06)	-.27	.21	
Block 2				.234 *
Sex	.05 (.29)	.04	.85	
Age	-.07 (.05)	-.27	.18	
PANAS_NEG [3]	-.26 (.12)	-.41	.04 *	
nback_d_av [4]	-.24 (.16)	-.29	.14	

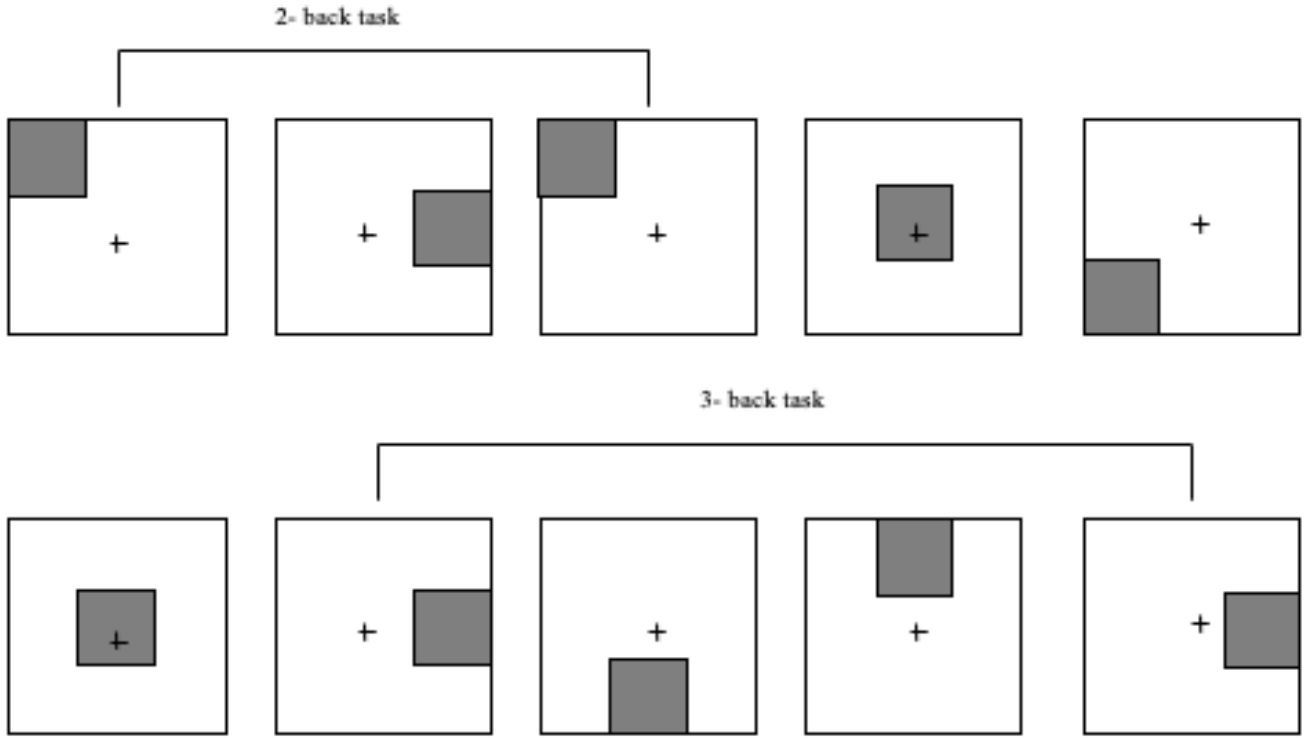
* p < .05, ** p < .01, *** p < .001

[3] Positive and Negative Affect Schedule-Expanded Form- Negative Emotions

[4] nBack task (working memory) - average d' from 2 and 3 back conditions

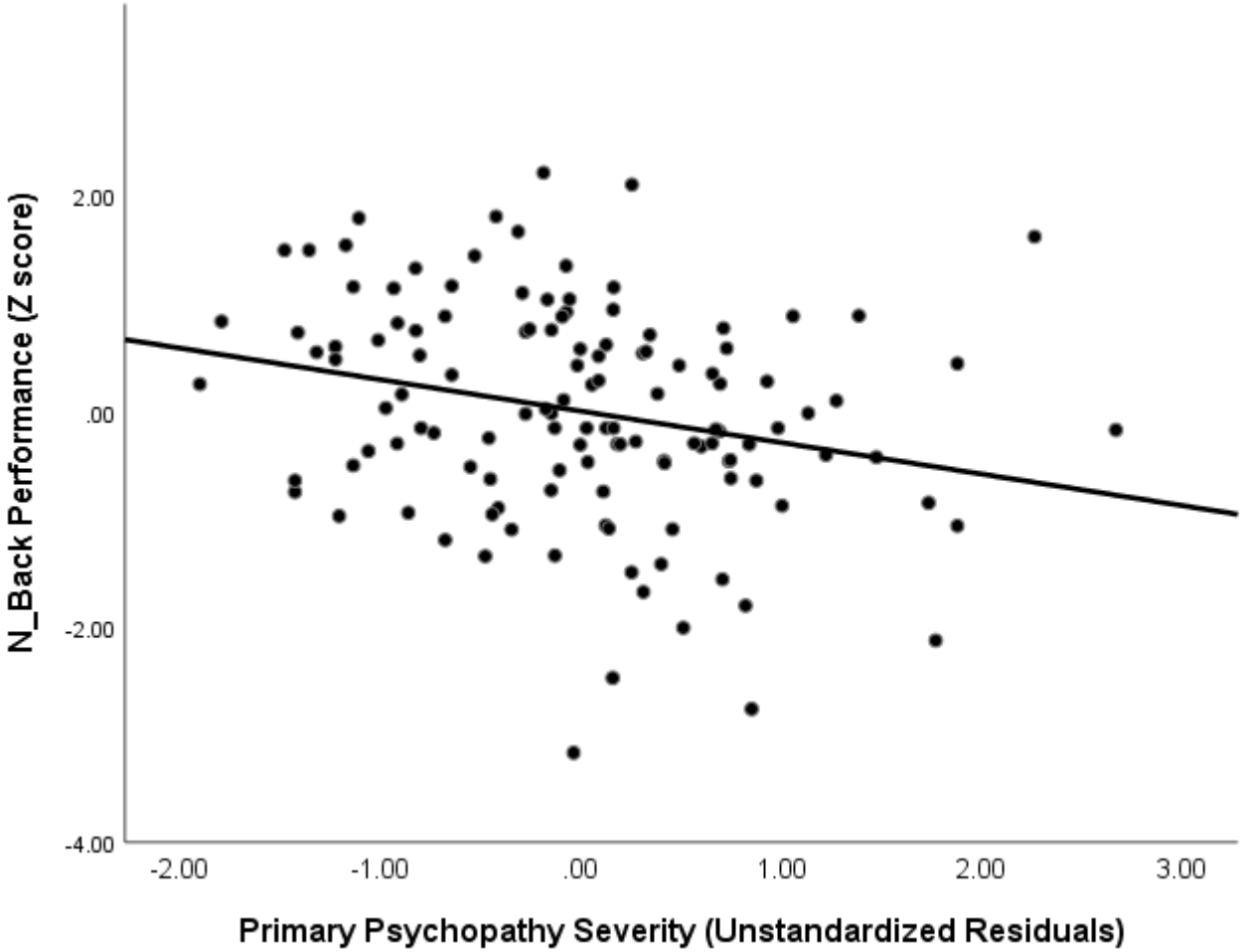
FIGURES

Figure 1. Example of a two and three-back visuo-spatial n-back working memory task[1]



[1] This example is based on Figure 1, a representation of the n-back task, found in Schwippel et al. (2018). As can be indicated by the brackets above both trials, participants are asked to identify if the blocks placement is in an identical location to the block that was seen n-1,2, or 3. While this figure depicts nine locations, our version used eight locations (all locations shown above except for center position).

Figure 2. Scatterplot of relationship between primary psychopathy severity and working memory performance.[2]



[2] Performance on n-back is average of d' from 2- and 3-back

Figure 3. Scatterplot of the relationship between frequency of negative emotion experience and strength of negative emotion expression for participants with high primary psychopathy and high volitional suppression of negative emotions (n = 25)